Malaria

Malaria is a Class B Disease and must be reported to the state within one business day.

Background

Malaria is caused by a protozoan parasite that is transmitted by Anopheles mosquitoes. There are five species of malaria parasite: *Plasmodium falciparum, P. vivax, P. ovale, P. malariae, and P. knowlesi.* The fifth species, *P. knowlesi*, a simian malaria parasite, has recently been observed transmitting malaria to humans in Southeast Asia. It was discovered in Malaysia; several human cases have also been reported in Thailand, Myanmar and the Philippines.

Malaria is transmitted to humans through the bite of an infective mosquito who has previously taken a blood-meal from an infected human. Therefore, people usually only become infected with malaria if they live in, or travel to countries where there is regular malaria transmission. Transmission also occurs rarely through blood transfusions and congenitally (infected mothers infecting their child during pregnancy).

Symptoms usually begin ten days to four weeks after infection; two malaria species, *P. vivax* and *P. ovale*, can cause relapses. Symptoms commonly include fever and flu-like illness (chills, headache, muscle aches and tiredness), and can also include nausea, vomiting, diarrhea, anemia and jaundice. If left untreated, malaria can cause kidney failure, seizures, mental confusion, coma, and death. There are several anti-malarial drugs available that should be taken early on in the course of illness.

History

In the late 19th Century, approximately half of the United States was endemic with malaria. At the turn of the 20th Century, when the prevalence of malaria was approximately 350 cases per 100,000, the U.S. Public Health Service established improved protocols to control and reduce the spread of malaria. In 1933, The U.S. Tennessee Valley Authority bill was signed to improve and develop the land and waterways in the Tennessee River valley region, where 30% of the population was affected by malaria. The bill led to the creation of a malaria control program which reduced mosquito breeding sites and utilized insecticide applications. In 1939, Dichloro-diphenyl-trichloroethane (DDT) was discovered and, by the end of WWII, was being used for malaria control. In 1942, the Malaria Control in War Areas (MCWA) was established to control malaria around military bases in the southern U.S. and its territories. In 1947, the National Malaria Eradication Program (NMER) was created as a cooperative effort with state and local health agencies of 13 southeastern states and the CDC, whose efforts consisted primarily of house-spray applications. Malaria was successfully eradicated in the U.S. in 1951.

In the 1940s, Louisiana had a peak case rate of 57 cases per 100,000, (reported in 1944). In 1947, after the initiation of the NMER, the case rate reduced to eight cases per 100,000, and was further reduced to 0.2 cases per 100,000 four years later. In the early 1950s, there was another peak of malaria cases secondary to the Korean War, with 18 cases per 100,000 (reported in

1952). With the exception of small rises in cases during times of war (Vietnam - 1967-71; Gulf War – 1980), Louisiana maintains a strict malarial control. Almost all of the cases of malaria that have been reported since its eradication were imported from overseas travel, or immigrants.

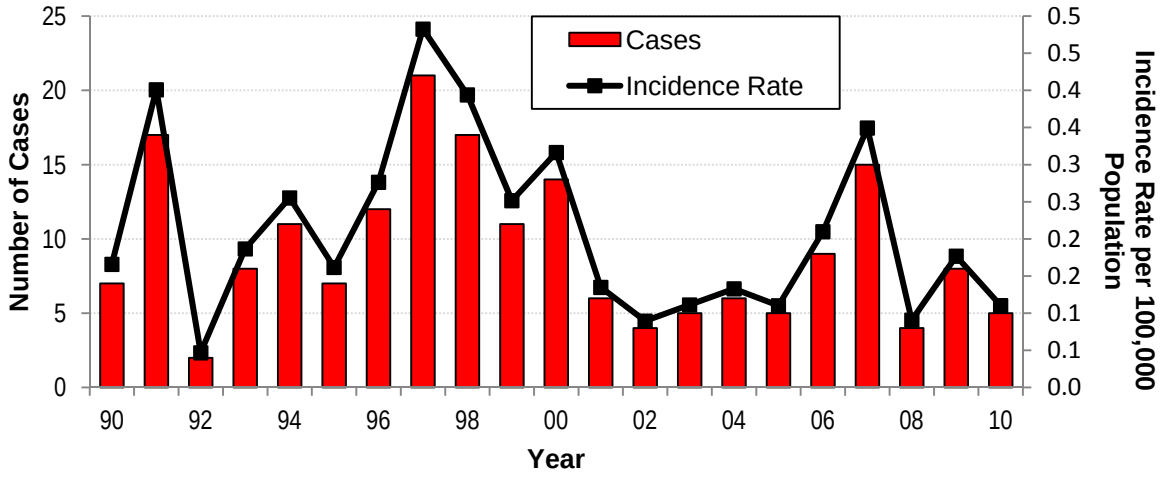
The epidemiologic picture of malaria in Louisiana is that of an imported disease. It reflects the pattern of travel from malarious areas as described below. Therefore it would be expected to observe peaks and troughs following the arrivals of:

- Immigrations and refugees
- Military campaigns
- Business trips
- Foreign students
- Tourists

Incidence in Louisiana

In 2010, there were five cases of malaria reported in Louisiana, which is below the average over the past 20 years of nine cases per year. The incidence rate in 2010 was 0.11 per 100,000 population, which is also lower than the 20-year average incidence rate of 0.21 per 100,000 population (Figure 1).

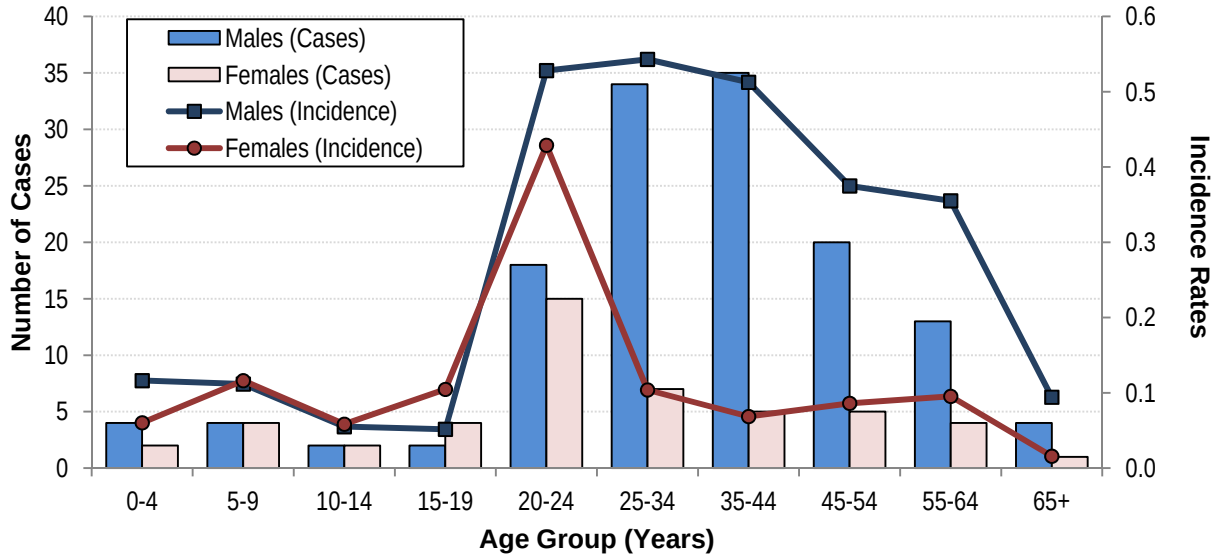
Figure 1: Malaria Cases and Incidence Rate - Louisiana, 1990-2010



Incidence Rates by Sex and Age

For the period 1990 to 2010, there was an average of 6.8 cases per year for males and 2.43 cases per year for females. The average incidence rate for males was 0.28 cases per 100,000 population and 0.09 cases per 100,000 population for females, and the rate ratio for M/F = 3.17, $p<0.000$, 95% CI = 2.23 to 4.49. The majority of the malaria cases were adult males (range 20-64 years). Among the females, the majority of the cases were young adults aged 20 to 24 years (Figure 2).

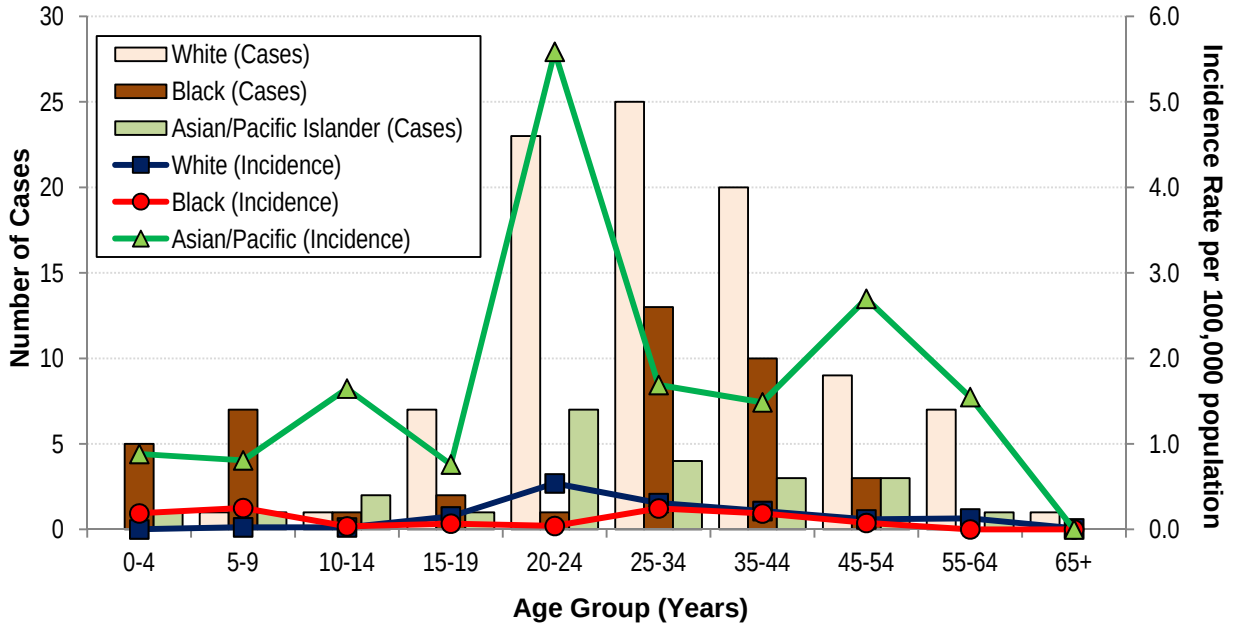
Figure 2: Malaria Cases and Incidence Rates by Sex and Age - Louisiana, 1990-2010



Incidence Rates by Race and Age

For the period 1990 to 2010, there was an average of 4.5 cases per year for Whites (W), two cases per year for Blacks (B), and 1.1 cases per year for Asian/Pacific Islanders. However, if the population size for each group is considered, Asian/Pacific Islanders (AP) had a much higher incidence rate than the other two groups of 1.8 cases per 100,000 as compared with 0.16 per 100,000 for Whites and 0.12 per 100,000 for Blacks over the 20-year period (Figure 3).

Figure 3: Malaria Cases and Incidence Rate by Race and Age - Louisiana, 1990-2010

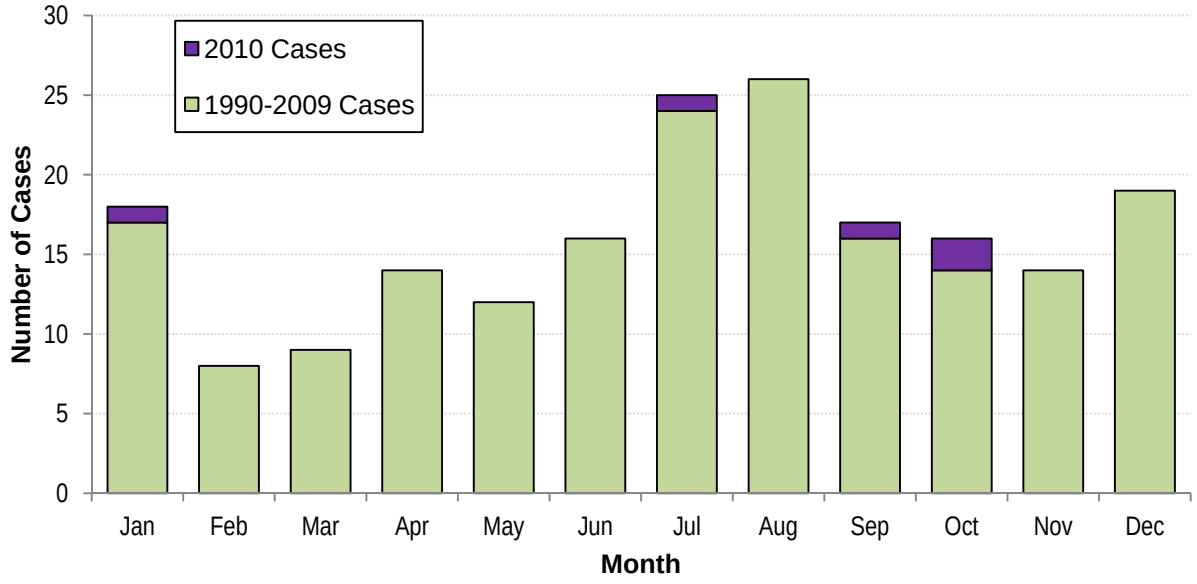


The rate ratio for AP/W = 11.3, p<0.000, 95% CI = 6.8 to 17.9, and the rate ratio for AP/B = 14.76, p<0.000, 95% CI = 8.5 to 25.1. Among Asian/Pacific Islanders, the highest incidence rate occurs among 20 to 24 year-olds. Whites also show a peak in incidence rate among 20 to 24 year-olds. Blacks show a different age distribution with higher incidence rates occurring among newborn to nine year-olds and also among 25 to 34 year-olds.

Malaria Cases by Month

The seasonal distribution of malaria over the past 20 years reveals a peak in July and August (Ratchet circular scan test for seasonal peak, p<0.01), with the fewest cases occur in February and March (Figure 4).

Figure 4: Total Malaria Cases by Month - Louisiana, 1990-2010



Malaria Cases by Parish

The geographical distribution of malaria by parish over the past 20 years shows a small number of cases in both urban and rural parishes. Overall, there were improvements in malaria control across the state for the years 1990 to 1999 and 2000 to 2009, specifically noting Caddo, East Baton Rouge, and Orleans parishes (Table 1).

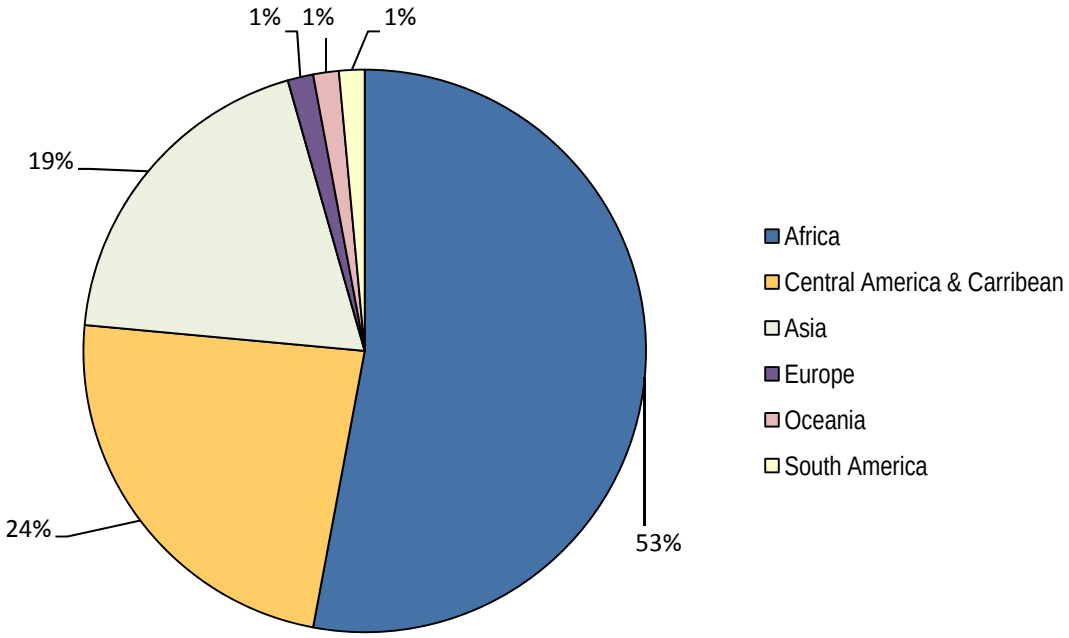
Table 1: Malaria Cases by Parish - Louisiana, 1990-2010
Average Number of Cases in 1990-1999 and 2000-2009 Compared to the Total Number of Cases in 2010

Region	Parish	1990-1999 Average	2000-2009 Average	2010 Cases	Region	Parish	1990-1999 Average	2000-2009 Average	2010 Cases
1	Jefferson	1.1	0.8	0	6	Concordia	0.0	0.0	0
	Orleans	2.7	1.2	1		Grant	0.1	0.0	0
	Plaquemines	0.1	0.0	0		La Salle	0.0	0.0	1
	St. Bernard	0.0	0.0	0		Rapides	0.2	0.2	0
2	Ascension	0.1	0.0	0		Vernon	0.5	0.8	0
	E. Baton Rouge	2.1	0.8	0		Winn	0.0	0.0	0
	E. Feliciana	0.0	0.0	0	7	Bienville	0.0	0.0	0
	Iberville	0.0	0.0	0		Bossier	0.1	0.1	0
	Pointe Coupee	0.0	0.0	0		Caddo	0.9	0.0	0
	W. Baton Rouge	0.0	0.1	0		Claiborne	0.0	0.0	0
	W. Feliciana	0.0	0.0	0		De Soto	0.0	0.0	0
3	Assumption	0.0	0.0	0		Natchitoches	0.2	0.1	0
	Lafourche	0.1	0.2	0		Red River	0.0	0.0	0
	St. Charles	0.0	0.1	0		Sabine	0.0	0.0	0
	St. James	0.0	0.0	0		Webster	0.1	0.0	0
	St. John	0.2	0.0	0	8	Caldwell	0.0	0.0	0
	St. Mary	0.2	0.1	0		E. Carroll	0.0	0.0	0
	Terrebonne	0.2	0.2	0		Franklin	0.0	0.0	0
4	Acadia	0.1	0.0	0		Jackson	0.0	0.0	0
	Evangeline	0.0	0.0	0		Lincoln	0.2	0.2	0
	Iberia	0.1	0.0	0		Madison	0.0	0.0	0
	Lafayette	1.0	0.7	1		Morehouse	0.0	0.1	0
	St. Landry	0.1	0.0	0		Ouachita	0.0	0.1	1
	St. Martin	0.0	0.1	0		Richland	0.0	0.0	0
	Vermilion	0.0	0.1	0		Tensas	0.0	0.0	0
5	Allen	0.0	0.0	0		Union	0.0	0.0	0
	Beauregard	0.1	0.0	0		W. Carroll	0.1	0.1	0
	Calcasieu	0.5	0.3	0	9	Livingston	0.0	0.1	0
	Cameron	0.0	0.0	0		St. Helena	0.0	0.0	0
	Jefferson Davis	0.0	0.0	0		St. Tammany	0.1	0.4	1
6	Avoyelles	0.0	0.0	0		Tangipahoa	0.1	0.1	0
	Catahoula	0.0	0.0	0		Washington	0.0	0.0	0

Travel Locations

All reported cases of malaria were acquired outside of the United States. The majority of malaria cases (53%) reported, travel to Africa prior to illness, followed by 24% reporting travel to Central America and the Carribean, and 19% reporting travel to Asia. Within those regions, the majority of cases report traveling to either Nigeria, Honduras or Afghanistan. Only a few cases reported traveling to Europe, Oceana or South America (Table 2).

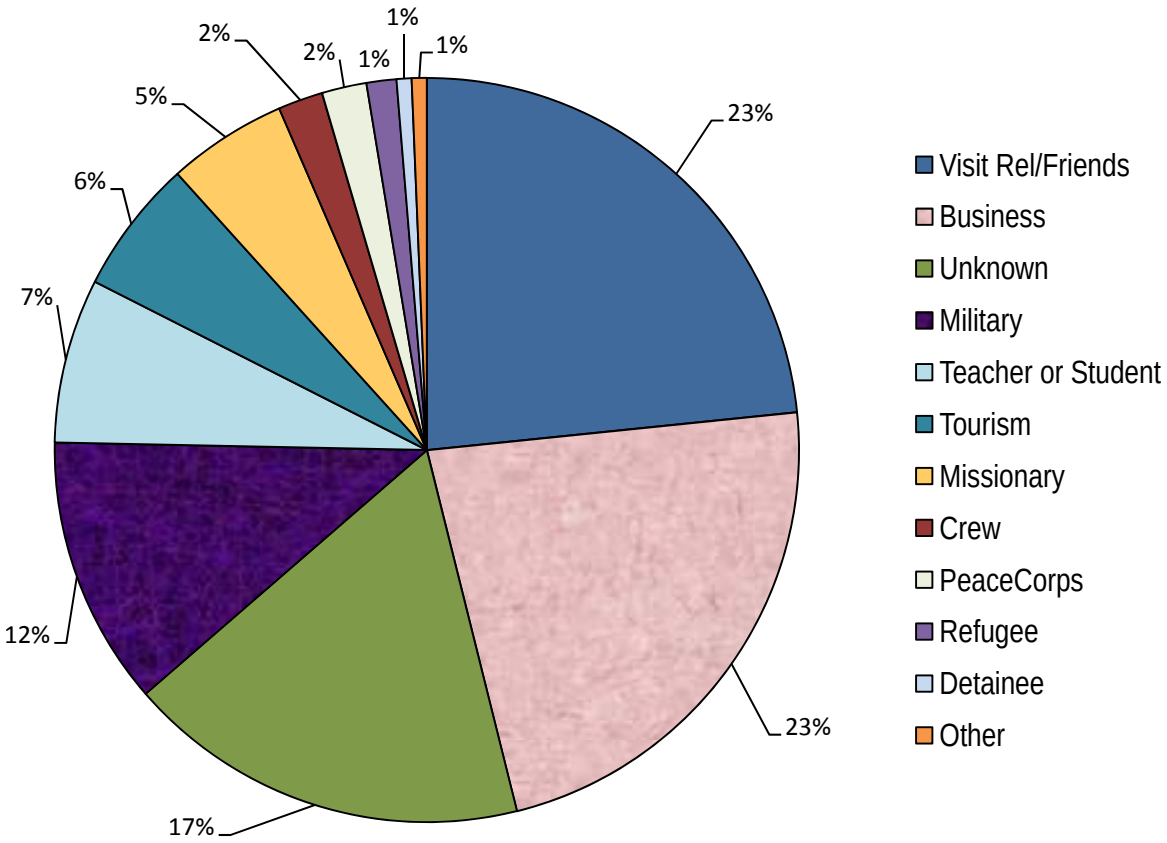
Table 2: Malaria Cases Travel Locations Prior to Illness – Louisiana, 2000-2010



Reason for Travel

The most common reasons for travel reported by malaria cases from 2000 to 2010 were visiting relatives and/or friends and business (23% each), followed by unknown reason (17%), and military (12%). Fewer cases reported being a teacher or student, tourism, missionary, crew, Peace Corps, refugee, detainee, or Other as reasons for travel (Table 3).

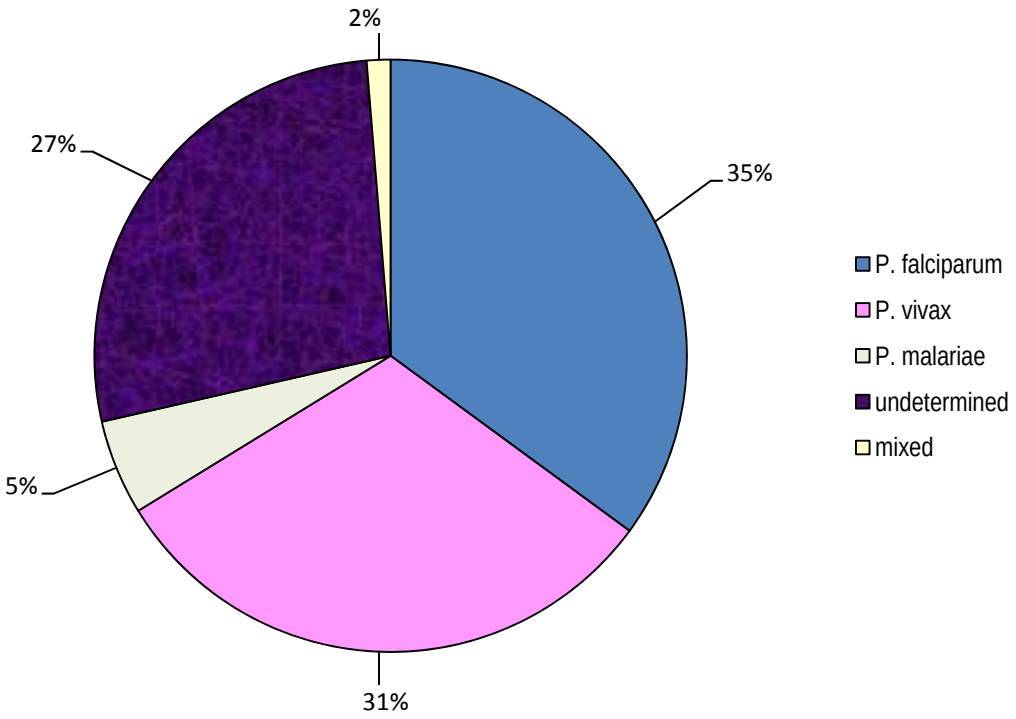
Table 3: Malaria Cases Reason for Travel - Louisiana, 2000-2010



Plasmodium Species

The majority of reported malaria cases were infected with *P. falciparum* (35%), followed by *P. vivax* (31%), and *P. malariae* (5%). Species were undetermined in 27% of malaria cases; mixed species were reported in 2% of cases (Table 4)

Table 4: Plasmodium Species – Louisiana, 2000-2010



Mortality

Only one death was reported among malaria cases from 2000 to 2010, which occurred in 2003.

Prevention

Due to the resurgence of malaria during the past decade, travelers to malarious areas need to protect themselves against acquiring infection. Preventing mosquito bites by using insect repellent and bed nets, as well as preventing malaria infection through the use of chemo-prophylaxis are both preventive measures. The traveler's risk of acquiring malaria in areas to be visited determines the appropriate prevention regimen. Anti-malarial drugs are often highly important in preventing malarial infection, however failure of prophylaxis may occur for numerous reasons.

- First, travelers may not seek or follow advice or may receive inaccurate advice regarding anti-malarial medication.
- Second, travelers may forget to use prophylaxis, may not completely understand chemo-prophylactic advice, or may be advised by peers not to use chemoprophylaxis.
- Third, persons who visit friends or relatives living in areas with endemic malaria often are less likely than other tourists to obtain pre-travel advice to use chemoprophylaxis.

- Fourth, many physicians infrequently provide pre-travel advice to patients, and may not be aware of the current recommendations.
- Fifth, travelers may have side effects from the chemoprophylaxis regimen prescribed for them, so they discontinue their regimen while in malarious endemic regions.